MUNICIPAL GAS AND ELECTRIC PLANTS IN MASSACHUSETTS.

I.

MUNICIPAL electric plants in Massachusetts had their beginning at Danvers in 1888. In that year the town appropriated money for and built an electric generating station with distribution lines and arc street lamps. At first no attempt was made to supply private consumers, but the town petitioned the legislature for authority to engage in such supply, and a bill to that effect was introduced in the session of 1888–89. The petition to the legislature for this authority seems to have been based on the almost unanimous desire of the citizens of the town, as the town vote in favor of it was 194 to 7. Notwithstanding this, the bill introduced to meet the wishes of the town was defeated by forces that can readily be imagined, in view of the fact that the general supply of both gas and electricity throughout the state was at that time in the hands of private corporations and individuals.

In 1889, after the request of Danvers had been denied, the Danvers Gas Light Company sought and obtained from the gas and electric light commissioners authority to engage in electrical supply, but has never done so, probably through fear of competition by the town plant.

The course taken by Danvers no doubt served to strengthen the demand for public ownership of gas and electric plants, which resulted in the so-called municipal act of 1891, or chapter 370 of that year. This act was evidently a compromise, since, while it confers on cities and towns the authority to engage in gas and electrical supply for both public and private purposes under certain restrictions, it imposes on cities and towns that accept the act the obligation to purchase existing plants where the owners desire to sell.

In the same year with this general law a special act was passed, chapter 378 of 1891, legalizing the doings of Danvers as to its municipal plant and giving it authority to supply electric light to its citizens. Since the passage of the general municipal act of 1891, and up to the close of the calendar year 1900, sixty-one cities and towns of the state

have taken some official action looking to the establishment of gas or electric plants. The net result of all this activity up to the end of the year just named has been the purchase or erection of eighteen municipal plants. Some explanation of this apparent lack of real desire for municipal ownership may be found in the fact that nearly all of the cities and towns mentioned, like the great majority of those having more than 1,500 population, in the state, were at the time of their action provided with private gas or electric plants which it might become necessary to purchase. Following are given the names, populations, years of starting, and kind of supply for cities and towns having municipal plants:

MUNICIPAL GAS AND ELECTRIC PLANTS IN MASSACHUSETTS.

Name.	Population.	Year started.	Supply.
Belmont	3,929	1898	Electrical
Braintree	5,981	1892	"
Chicopee	19,167	1896	"
Concord	5,652	1900	"
Danvers	8,542	1889	"
Hingham	5,059	1894	"
Hudson	5,454	1897	"
Hull	1,703	1894	"
Marblehead	7,582	1895	"
Middleboro	6,885	1893	" and gas
Needham	4,016	1893	"
North Attleboro	7,253	1894	"
Peabody	11,523	1892	"
Reading	4,969	1895	"
Taunton	31,036	1897	"
Wakefield	9,290	1894	" and gas
Wellesley	5,072	1892	"
Westfield	12,310	1899	" and gas

Belmont, Hingham, and Wellesley have only distribution systems, and buy energy from private generating plants in other towns. Needham also lacks a generating station, and obtains electrical energy from a private plant located within the town. The other fourteen municipal plants include generating as well as distributing equipments. Needham and Wellesley devote their plants almost exclusively to street lighting, but the other sixteen places supply both public and private lamps. Gas as well as electric light is supplied from the municipal plants in Middleboro, Wakefield, and Westfield. The list includes sixteen towns and two cities. Population stood at 31,036 for Taunton,

the largest city, in 1900, and at 1,703 for Hull, the smallest town. The total population of the eighteen cities and towns having municipal gas and electric plants was 155,423 in the year just named. New plants have been established with fair regularity as to time since the passage of the municipal act in 1891. Three plants began operation in 1892, two in 1893, four in 1894, two in 1895, one in 1896, two in 1897, one in 1898, one in 1899, and one in 1900. The somewhat slower rate at which cities and towns have established new plants since 1895 is probably due to the fact that the places where existing private systems would not have to be purchased have only very small populations. Of the six municipal plants started since 1895 those at Chicopee, Hudson, Taunton, Belmont, and Westfield were bought as the results of suits brought by private corporations, and the plant at Concord has alone been built by the town, without such a purchase. Twelve gas or electric plants were started by cities and towns prior to 1896. Middleboro, Hull, Wakefield, and Hingham bought existing systems, but Braintree, Peabody, Wellesley, Needham, North Attleboro, Reading, Marblehead, and Danvers built entirely new plants. Up to and including the year of 1895, 66 per cent. of the municipal plants were built by the towns, but since that date 80 per cent. of those added have been acquired through compulsory purchase.

No private generating station for general electrical supply exists in any town or city where there is a like municipal plant. Needham with only an electrical distribution system contains a generating station under private ownership, but no other place with a municipal plant has such a station. This generating station in Needham supplies private consumers as well as the town plant. The town electric plant in Wellesley draws its energy from a private generating station in Natick, and private consumers are supplied from the same source. A part of Chicopee, probably that beyond the service area of the municipal plant, has electrical supply for private consumers from a generating station in an adjoining town. Gas companies do a general business in Belmont, Chicopee, Danvers, Marblehead, North Attleboro, Peabody, Taunton, and Wellesley. In these eight places the municipal electric plants are thus subject to the competition of gas systems under private ownership. The net price of gas per 1,000 cubic feet is $1.80 in Belmont; $1.75 in Chicopee; $2.125 in Danvers; $2.125 in Marblehead; $1.45 in North Attleboro; $1.30 in Peabody; $1.30 in Taunton; and in Wellesley $1.25, to small consumers for illuminating

purposes. With the original municipal plant at Danvers there were four in 1892, six in 1893, ten in 1894, twelve in 1895, and the number increased in 1896 to thirteen, in 1897 to fifteen, in 1898 to sixteen, in 1899 to seventeen, and in 1900 to eighteen.

The municipal electric plants were originally devoted mostly to street lighting, and some have continued in this line exclusively. Some idea of the growth of these plants may be got from the numbers of street lamps supplied by them in each year, as given by the accompanying table. The numbers of lamps stated are for fiscal years ending on June 30 in each case. As the legal right of Danvers to establish a plant was questioned, and the entire subject of municipal gas and electric plants was before the legislature, no such plants were established between 1889 and 1892.

NUMBER OF ELECTRIC STREET LAMPS IN OPERATION BY THE MUNICIPAL PLANTS OF MASSACHUSETTS AT THE END OF EACH FISCAL YEAR.

Year ending, June 30.	Arc street lamps.	Incandescent street lamps.	Year ending, June 30.	Arc street lamps.	Incandescent street lamps.
1889.....	73	.....	1896.....	996	2,436
1892.....	82	.....	1897.....	1,012	2,331
1893.....	307	452	1898.....	1,199	2,830
1894.....	416	1,086	1899.....	1,343	2,938
1895.....	734	2,535	1900.....	1,389	3,324

Since June 30, 1893, the end of the first fiscal year for plants established under the municipal act of 1891, the number of arc street lamps has increased from 307 to 1,389 on June 30, 1900, or 352 per cent. This for the seven years is at the average rate of 50 per cent. yearly over the number for 1892. During the same period the number of incandescent street lamps has increased from 452 to 3,324, or 635 per cent., an average of 90 per cent. yearly over the initial numbers.

Investments in municipal plants have gone up even faster than the numbers of street lamps operated by them. The rapid increase of these investments has been largely due to extensions of plants for purposes of commercial service. To determine the fiscal year in which investments, operating expenses, and earnings of municipal plants should first appear, it is necessary to note the month as well as the year when each plant began operation or came under town management. Each fiscal year ends on June 30 of the calendar year by which it is designated. Investments are given as of June 30 in each year,

and earnings and expenses are for the twelve months ending at that date. The investment for the fiscal year 1892 thus includes only that at Danvers, because the three new plants of the calendar year 1892 were all started in operation during its second half. In the same way, the investment for 1893 includes only plants started in 1889 and 1892.

DATES OF STARTING MUNICIPAL PLANTS.

Danvers, January 2, 1889.	Wakefield, August 7, 1894.
Braintree, October 15, 1892.	Marblehead, January 1, 1895.
Wellesley, December 13, 1892.	Reading, first half 1895.
Peabody, September 27, 1892.	Chicopee, May 28, 1896.
Needham, November 6, 1893.	Hudson, January 15, 1897.
Middleboro, December 15, 1893.	Taunton, July 1, 1897.
Hingham, April 1, 1894.	Belmont, May 3, 1898.
Hull, October 15, 1894.	Wakefield, June 1, 1899.
North Attleboro, February 22, 1894.	Concord, February 1, 1900.

The money earnings of municipal plants are derived from commercial service, and none of these plants supplied private consumers prior to the fiscal year of 1894. On June 30 of that year Braintree, Peabody, Middleboro, and Hingham were supplying private as well as public lamps. Before the middle of 1895, Hull, Marblehead, North Attleboro, and Wakefield were added to the towns engaged in commercial service from gas or electric plants. During the fiscal year of 1896 Reading began to supply electric light to private consumers. In the year ending June 30, 1897, Chicopee, Danvers, and Hudson began commercial service. Belmont and Taunton undertook commercial business before the middle of 1898.

Commercial as well as public lighting from the municipal plant at Westfield dates from June 1, 1899, the day on which its transfer to the town was completed. Concord began to supply private consumers shortly after its plant was started on February 1, 1900. The original investment of $15,000 at the Danvers plant in 1889 had increased to $16,555.68 by June 30, 1893, and the sums expended in the three new plants brought the total investment for all four up to $129,700.39, on that date. Just seven years later, the entire investment in the eighteen municipal gas and electric plants was $1,468,807. Compared with the sum expended by 1893, this last figure shows an addition to investments of 1032 per cent.

TOTAL INVESTMENTS, EXPENSES, AND MONEY EARNINGS OF ALL MUNICIPAL GAS AND ELECTRIC PLANTS IN MASSACHUSETTS.

Year ending June 30.	Investments.	Expenses.	Money earnings.
1889	$15,000	.....	.....
1892	15,694	.....	.....
1893	129,700	$11,095.85	.....
1894	249,223	29,845.08	$8,211.68
1895	660,029	86,389.12	45,947.45
1896	786,792	108,893.32	55,098.46
1897	933,776	134,413.20	70,291.86
1898	1,144,267	161,621.91	108,972.11
1899	1,335,585	177,437.61	117,264.32
1900	1,468,807	207,441.29	165,866.76

The figures given for expenses in the fiscal year of 1893 do not include those of the Danvers plant, because this plant is not reported as of June 30 until 1894. Investment figures for Danvers in 1893, as well as those of previous years, are not given for June 30, but apparently for February 1. This fact is not very material for present purposes, because additions to the Danvers plant were made very slowly during these years. From 1893 to 1900 the average addition to the total investments in municipal gas and electric plants during each fiscal year was 147 per cent. of their sum at the beginning of the period. This rate of increase has been nearly maintained to date, as the average annual addition to these municipal investments during the last two years has been 125 per cent. of the amount in 1893. That this expansion of municipal plants has been largely due to the increase of their commercial service is shown by the course of expenses and money earnings. During the fiscal year of 1894, the first in which municipal plants supplied private consumers, the money earnings from this commercial service were only 27 per cent. of the operating expenses of the plants. For the fiscal year of 1900 the money earnings of all municipal plants were 80 per cent. of their operating expenses.

The law limiting the indebtedness of cities and towns in general does not apply where expenditures are to be made for gas and electric plants. In the municipal act of 1891 the general law is replaced by the provision that the par value of bonds issued for the purchase of such a plant, and outstanding, shall not exceed 5 per cent. in the case of a town, or 2½ per cent. in a city of the total value of estates therein, as fixed by the last preceding state valuation.

RATIO OF INVESTMENTS IN MUNICIPAL GAS AND ELECTRIC PLANTS TO PROPERTY VALUATIONS IN THE CITIES AND TOWNS WHERE THE PLANTS ARE LOCATED.

City or town	Per cent.	City or town	Per cent.
Belmont	0.38	Middleboro	3.26
Braintree	2.10	Needham	0.44
Chicopee	1.09	North Attleboro	1.97
Concord	0.91	Peabody	0.96
Danvers	0.91	Reading	1.70
Hingham	0.62	Taunton	0.73
Hudson	1.59	Wakefield	2.45
Hull	3.05	Wellesley	0.19
Marblehead	1.39	Westfield	1.84

Taunton and Chicopee are the only cities in this list. In the latter the investment in the municipal electric plant is less than one-half, and in the former less than one-third, of the limit set by law for city indebtedness on account of such plants. Among the towns only two, Hull and Middleboro, have investment in gas or electric plants that represent more than one-half of the debt limit. For the eighteen cities and towns the total investments in gas and electric plants is only 1.26 per cent. of the property valuations. But the total investment is necessarily greater than the indebtedness on account of these plants, because a part of the bonds issued for their purchase have been paid.

TAX PER $1,000 OF VALUATION IN TOWNS THAT HAD MUNICIPAL PLANTS IN 1895.

Towns.	Tax in 1895.	Tax, 1900.	Towns.	Tax in 1895.	Tax, 1900.
Braintree	$17.60	$19.60	North Attleboro	$24.00	$22.50
Danvers	17.00	14.40	Peabody	17.60	18.40
Hingham	16.00	16.00	Reading	15.50	17.50
Marblehead	17.90	15.60	Wakefield	18.50	17.20
Middleboro	16.66⅔	20.70	Wellesley	11.00	11.00
Needham	14.60	14.00			

Of the twelve towns with municipal gas or electric plants in 1895, two had the same tax rate in that year as in 1900. Five of these towns show an increase and five show a decrease of the tax rate between the years just named. It seems that no definite conclusion can be drawn from these tax rates, either for or against town ownership of gas and electric plants. Indeed, the operations of these plants seem to be on

too small a scale to materially change the tax rates. Thus Middleboro shows an increase of taxes in 1900 over 1895 of more than $4 per thousand, and the valuation of estates in 1900 was $3,321,673. The increase in tax rate of $4 per thousand, when applied to this valuation, yields $13,286.69, but the excess of expenses over money earnings of the plant at Middleboro in 1900 was only $609.59. On the other hand, it would require minute investigation to determine whether the decreased rates were due to the operation of municipal plants.

One of the most striking features in connection with municipal electric plants in Massachusetts is the absence of any serious competition with them by similar private plants. This condition seems to be due to a fear on the part of private corporations to engage in such competition. Ten of the cities or towns that have established electric plants, contained previously existing private systems of the same sort. In each of these ten places the private plant has either been purchased by the city or town, or else the owners of the private plant have endeavored to force such a purchase. In nine places the city or town has purchased the existing electric system, but in one town, North Attleboro, the private corporation filed its schedule, as required by law to enforce the purchase of its plant, but never carried its case to trial, and the plant was not purchased. This private plant was subsequently removed from the town. The fear of municipal competition or the hope to obtain high prices is the only apparent motive for these sales of private systems to the cities or towns. The private corporations in these ten places might have retained their plants and competed with the town plants. Under the municipal act of 1891, cities and towns have no power to compel the sale of existing gas or electric plants, though the owners of such plants can compel the cities or towns in which they are located to purchase. After cities or towns decide by the required vote to establish gas or electric plants, they are not permitted by the municipal act to withdraw any rights in their streets or ways previously granted to similar plants.

Private corporations have no reason to fear competition by town or city plants on any other than a paying basis. Under the law, the prices charged for gas or electrical energy by the cities and towns must include, in addition to operating expenses, interest on the entire investment at the rate paid on municipal bonds, depreciation at 5 per cent. yearly, on the cost of the plants, and sufficient depreciation charges to pay the bonds, issued for the purchase of the plant,

when they fall due. The commissioners may permit a municipal plant to sell gas or electric light at less than a price computed on the basis just named, but it is against their policy to do so. In only one instance, that of Hudson in 1898, have the commissioners consented to a price below that required by statute. In this case the low price was authorized for only five months, when the plant had operated a few months, and on a state of facts that seemed to indicate a lower cost per unit of output in the near future. The small private electric station at Needham, where the municipal plant does no commercial lighting, has been operated about two years by a partnership that is also engaged in another business. At Danvers, the gas company, though authorized by the commissioners to supply electric light, has never exercised the privilege.

II.

FINANCES

Under chapter 370 of the acts of 1891, and chapters 356 and 480 of the acts of 1896, the board of gas and electric light commissioners of Massachusetts have ample powers to prescribe the way in which all accounts of municipal gas and electric plants shall be kept. In addition to the annual sworn reports of these accounts, which must, according to law, be made to the commissioners, they have authority to demand additional reports in any detail whenever they so desire.

The commissioners have exercised their powers through an elaborate set of rules and forms regulating all the accounts of municipal gas and electric plants.

The annual reports of the commissioners contain the substance of the reports from all of the cities and towns owning gas and electric systems, and constitute the most important and accurate body of data relative to such municipal plants that has ever been compiled in the United States. From these reports, which are the main source of information for the present paper, it is possible to determine accurately the investments, earnings, expenses, assets and costs of service in all the municipal gas and electric plants of the state.

It is well known that the financial showing made by corporate and municipal enterprises depends to a very large extent on the ways in which such items as investment, depreciation, operating expenses and construction accounts are treated. The object here is to point out

just how these and related items are determined under the system enforced by the commissioners for the municipal plants.

Money to pay for the purchase, construction or extension of municipal plants may be obtained by the sale of bonds not to run more than thirty years. Short time loans, payable from taxes from year to year, may be made to cover operating expenses. All expenses incurred in connection with municipal plants are appropriated and paid from the city and town treasuries. All money earnings of these plants are paid into the treasuries of the cities and towns.

Under the heading of investments in municipal plants are included all loans and appropriations expended for construction purposes. An illustration of investment charges may be seen in the town of Belmont. In 1898 this town sold bonds to the par value of $14,000 for the purchase and extension of a small electric plant, and the investment stood at $14,000 for that year. During 1899 $4,000 were appropriated for construction purposes and the investment was raised to $18,000. Again, in 1900, $3,000 were appropriated for construction, and besides this there was an overdraft of $1,186.88 for the same purpose, raising the total investment to $20,186.88.

The rules of the commissioners require that whenever an appropriation for construction is made by a town or city, whether the amount is to be raised by taxation or the sale of bonds, the sum to be raised from taxes or the par value of the bonds issued be credited to the construction account. If city or town appropriations are by their terms applicable to either construction or maintenance, only the amount expended for new construction is charged to that account. When at the end of a fiscal year any unused portion of an appropriation for new construction is covered back into the city or town treasury, it is debited to the construction account.

One of the most important distinctions to be observed, in the expenditures of municipal as in those of private gas and electric plants, is that between outlays for operation and for construction. There is a tendency in some cases to charge items to construction or investment that are really a part of operating expenses. To guard against incorrect charges of this sort the rules of the commissioners separate electric construction charges under a number of headings.

Under real estate are included the cost of land and the buildings or other permanent structures thereon. The steam plant is debited with the first cost in place and ready for use of its engines, boilers,

and other apparatus. The electric plant account is debited with the cost in place and ready for use of the dynamos and all electric instruments and fittings in the station. Electric lines are charged with the cost of all labor and materials for the first construction of overhead or underground circuits outside of the station, except where these circuits are on private property or exclusively for private use. The cost of arc lamps and of their erection in place on the streets is debited to their account. Incandescent lamps, with the labor and fittings required when they are originally installed on the streets or in buildings owned and used by a city or town, are charged to the account of incandescent town lamps. This account does not include the cost of lamps for renewals or for private lighting.

Inside wiring is debited with the cost of all labor and materials used to install lamps on private property for private use, except where such cost is included in the jobbing account. No repairs of these private installations may be charged to the inside wiring account.

Where an existing plant is purchased for a lump sum, each of the accounts just considered must be opened and debited with a proportionate share of the total price. The jobbing account includes those cases where work to be paid for by customers is done in buildings or elsewhere, and is debited with the cost of all labor and materials used, and credited with all sums charged for this work. No materials or labor used to repair the electric plant are charged to this account. At the end of each year the balance of this account is transferred to the profit and loss account.

The various construction accounts just considered seem to be sufficiently defined to exclude improper items, but the rules of the commissioners are equally specific as to the expenses of operation. Expense accounts for electric plants are separated under twenty-three headings, namely, fuel, carbons, oil and waste, incandescent lamps, globes, water, station wages, real estate repairs, steam plant repairs, electric plant repairs, repairs of lines and lamps, station tools and appliances, distribution wages, distribution tools and appliances, general salaries, committee expenses, general office expenses, rents, insurance, law expenses, claims, bad debts, incidentals. Some of these headings require no explanation. Incandescent lamps and globes in the expense accounts do not include any used in the original installation of street lamps. Station wages do not cover any labor for repairs. All expenses of repairs on real estate, steam and electric plants, and

lines and lamps are included under these headings, but not so the renewal of incandescent lamps. Station tools and appliances includes all tools, furniture, and movable apparatus not covered by one of the previous expense items. Under distribution wages come all expenses for the care of apparatus outside of the station and for collection of accounts.

Under distribution tools and appliances come all expenses for articles of this sort used for the care, repairs, or maintenance of lines and apparatus outside of the station. Horses and wagons used for the electric business are included in this account. General salaries include that of the plant manager and others not previously covered. Committee expenses are incurred for purposes of traveling and investigation and for auditors of the accounts. Claims are the sums paid for injuries to persons or property by the plant.

At the close of each fiscal year each of these expense accounts goes to the debit of the manufacturing account, which is credited with the income from the sale of light and power. The manufacturing account is closed by transfer of its balance to profit and loss. All supplies, except fuel, carbons, oil and waste, globes and incandescent lamps, are charged to a material account when purchased, unless wanted for immediate use, and when any of the supplies are used their value is transferred to the debit of the account to which they are devoted.

Investments in gas plants include the items of real estate, machinery, and apparatus used in the manufacture of gas, street mains, and meters. Under operating expenses in the manufacture of gas are included those for coal not used for enriching, gas oil and enriching coal, purifying materials, water, wages at works, repairs, and maintenance of works, and tools, apparatus and machinery. To the expenses of gas distribution must be charged wages of meter takers and clerks and collectors, renewals and maintenance of mains and service pipes, distribution tools, repairs and renewals of meters, and the setting, repairs and renewals of gas stoves. General salaries, committee expenses, auditors' fees, office expenses, rents, insurance, law expenses, claims, bad debts, and incidentals are also charged to operation in gas as in electric plants.

As the reports of cities and towns to the commissioners are required to be under all of the headings stated, it is evident that no material error in the division of plant expenditures between construction and

operating expenses and in favor of the latter can occur without falsification of the accounts, which is not to be presumed.

The municipal ownership act requires that an annual depreciation of not less than 5 per cent. on the cost of each plant and its losses shall be computed as an element of the prices to be charged its customers for gas and electrical energy. Cities and towns usually compute depreciation at the minimum figure of 5 per cent. When a plant is purchased or installed, depreciation for the first fiscal year or fraction thereof that it is operated is calculated on the investment. For subsequent years the cost on which depreciation is calculated is the total investment at the beginning of each year minus all previous depreciation charges. When in the first half of any fiscal year considerable additions to investment in any plant are made, depreciation on these additions is computed at the regular rate for the second half of that year, and the resulting amount added to the main depreciation charge. Under this system the yearly depreciation charge grows constantly smaller unless the additions to the investment at least equal the amounts deducted for depreciation.

An illustration of the working of these depreciation charges may be seen in the case of the Taunton municipal electric plant. That city completed the purchase of, and began to operate its plant on July 1, 1897, the price paid being $125,000. For the fiscal year ending June 30, 1898, the depreciation charge for the Taunton plant was $6,504.91, or somewhat more than 5 per cent. of the price paid for it, because depreciation was also computed on some additions made to the plant during the first half of the fiscal year. The investment in the Taunton plant reached $139,401.75 on June 30, 1898, and $145,301.75 on June 30, 1899, but the depreciation charges for the years ending June 30, 1899, and June 30, 1900, were only $6,646.35 and $6,670.96, respectively, in spite of the fact that a part of the additions to investment occurred in the first half of each of these years.

It seems to be an open question whether this system of depreciation charges is more or less correct than one in which depreciation is calculated on the total investment at the beginning of each year. This latter method with a given per cent. of depreciation obviously results in a larger yearly charge. However this question may be decided there seems little doubt that the minimum rate of 5 per cent. named in the municipal act is ample to represent actual depreciation.

The practice in computation of the charges for depreciation in

municipal gas and electric plants applies the 5 per cent. to the cost of all parts of the plants, in accord with the apparent meaning of the act. Now 5 per cent. is too small a rate of depreciation for some of the steam and electrical apparatus of a plant, but on the other hand it is too much to allow on some other parts, and every plant includes land which may actually increase in value. As the amount of real estate used by a municipal gas or electric plant usually increases much more slowly than the generating and distributing apparatus, the item of real estate in the assets grows to be relatively less important from year to year, as deductions are made for depreciation. To get at the approximate value of real estate in any one of these plants it is thus necessary to go to the first available statement of assets, as the separate items are not given under the head of investments. When the plant at Taunton was purchased in 1897, real estate represented a little under one-fifth of the total investment. Real estate represented more than one-sixth of the investment in the plant at Westfield, purchased by the town in the year of 1899. Concord completed the construction of a plant in the year of 1900, and real estate required more than one-fifth of the investment.

In the reports of the commissioners the values assigned to the various plant assets represent the amounts actually paid for these items, less the depreciation charges that have been made against them. The item of cash includes all appropriations in the hands of the plant manager or subject to his draft. Every item of investment, therefore, decreases at the rate of 5 per cent. from year to year. An illustration of this may be seen in the values given for the item of real estate in the balance sheets of the Taunton plant. On June 30, 1898, this item stood at $21,612.74. A reduction of 5 per cent. brought it down to $20,532.11 on June 30, 1899, and another depreciation charge of a like per cent. reduced the item to $19,505.51 on June 30, 1901. The depreciation charges on this real estate for the two years were thus $1,080.63 and $1,026.60 respectively, though the land was probably increasing in value.

The municipal ownership act of 1891 requires each city and town that establishes a gas or electric plant and issues bonds in payment therefor, to provide a sinking fund for the payment of these bonds. The requirements of these sinking funds and the interest on the bonds must be met by annual appropriations from the town or city treasury.

The prices charged by a municipal plant for gas and electricity sold to private consumers are the same to all customers, except in so far as they are subject to general discounts, according to the amounts used or for prompt payment, of which anyone may take advantage. Prices to private consumers may not be put at less than cost, except with the written consent of the commissioners. Neither may such prices be greater than is necessary to afford above the cost a profit of more than eight per cent. yearly on the net investment in the plant. The word "cost," as defined in the act, has an unusual, but accurate meaning. This "cost" includes all operating expenses, interest on the net investment in the plant, less amounts received for jobbing, at the rate paid on its bonds, the requirements of the sinking fund established to meet these bonds, and the charges for depreciation.

In order to fix the prices of service to customers, the gas or electricity used by the town or city is charged to it at cost, as here defined. Under this definition of cost, a city or town will, when the bonds are paid, have got back their face value, with interest, will have accumulated a depreciation fund equal to the original investment, and will have whatever remains of the original plant besides. It should be noted, however, that the municipal act does not attempt to define the actual cost of electricity used by cities and towns, but merely gives "cost" a special meaning in order to fix prices to private consumers.

Incomes of municipal plants from the sale of gas, gas residuals, electrical energy and the rent of motors, meters, stoves, and engines are included in the manufacturing accounts. In most cases the value of gas and electricity used in public buildings is also placed with the income in the manufacturing account. On the other side of this account are placed all expenses of operation and management, as before outlined. Gains or losses from jobbing, and interest received from any source do not figure in the manufacturing account, but appear in profit and loss. No value for the electric street lighting is included in the manufacturing account, and the result is that the annual balance sheets show a loss in operation for almost every electric plant, because street lighting is a large part of the total service from such plants. This loss is merely nominal, and if a fair allowance is made for the value of street lighting the apparent loss is changed to a substantial gain.

Nowhere in the reports of the commissioners is any value assigned to the street lighting done by municipal plants, but the cost of this

lighting to cities and towns is computed. This cost is not the one specially defined in the municipal act for the purpose of fixing prices to private consumers, but fairly represents the outlays of cities and towns for street lighting from their electric plants. To determine the total cost of street lighting from each plant yearly, the nominal loss in operating is added to the interest on the investment at the rate paid on the bonds, and to the depreciation charge less jobbing gains and interest on current accounts. In any case where the value of electric light supplied in public buildings has not been included in the income as stated in the manufacturing account, this value is deducted from the nominal loss in operation, before the cost of street lighting is calculated. All the street lighting is done with electric lamps, and interest and depreciation on gas plants are not, therefore, included in the total costs of street lighting. The total cost of street lighting in each city or town is divided among the different electric lamps in proportion to the energy that each nominally consumes.

Owing to the legal provisions relative to municipal gas and electric plants, and to the rigid and minute oversight of their affairs by the commissioners, the results shown in the reports seem worthy of careful consideration.

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BOSTON.